

PROF. W. W. DOKOUTSCHAÏEFF AND N. M. SIBIRTZEFF.

SHORT SCIENTIFIC REVIEW

OF PROFESSOR DOKOUTSCHAÏEFF'S AND HIS PUPIL'S

COLLECTION OF SOILS,

EXPOSED IN CHICAGO,


IN THE YEAR 1893.



St.-Petersburg.

Типографія Е. Евдокимова, Большая Итальянская, д. № 11.

1893.



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PROFESSOR W. W. DOKOUTSCHAEFF'S AND HIS PUPILS
COLLECTION OF SOILS.

The whole collection is divided into four principal sections:
a) specimens of soils and subsoils, disposed after the physico-geographical regions of Russia; b) cuts of the soils; c) maps, tables, diagrams etc; d) essays, specially treating the soils of Russia.

A. First section of the collection: specimens of the typical soils (on the whole 139) of Russia, taken from all her physicogeographical regions.

All the specimens of the soils, with very few exceptions, I have taken after a strictly fixed plan, always observing the same principles.

The collection contains chiefly, samples of vegetable soils *), formed on the firm land (steppes, northern, meadows, etc.) by different kinds of primitive rocks, assisted by, the free influence of air and the active part of the plants and animals; the vegetable moulds manifest the tightest connexion with their subsoils and have no acid reaction. They form 99⁰/₀ of the tillage-land of Russia.

*) See my classification of soils, volume I «Materials to the taxation of grounds in the government of Nishni-Novgorod».

Nearly all the soils of this collection are after their composition argillous-sandy ones in the widest acceptation; a considerable part of them (№№ 8, 29, 39, 54, 55, 57, 60, 61, 62, 63, 69, *), 70, 71, 72, 73), has been submitted to a thorough chemical analysis; other specimens (№№ 2, 14, 18, 21, 24, 28, 30, 31, and 93) are taken in localities identical with those, where the analysis was made **).

The sandy and sandy-argillous soils, of which the collection contains only a very small number (4—5), are indicated at every particular specimen. All the specimens have been taken from dry and quite plain localities and always and everywhere there could be distinguished the three following levels (see cuts №№ I, III, IV, VII etc).

A.—level of the soil; B.—transitive level of the soil; C.—primitive-rock (subsoil).

The largest quantity of the specimens of the soil has been taken from the level A and not beneath 15—30 cm.; all the exceptions are indicated further on.

In relation to the climate, vegetation and primitive-rocks (very probably also in reference to their age), the whole European Russia is divided, according to the soil, into the following zones: northern, central, tschernosem (black-earth) and extreme south-zone; Crimea, Caucasus, western and eastern Siberia form more or less independent ***) dominions; the tschernosem-zone of European Russia even,

*) Sol of Kroutoi.

**) Both analysis can be found in the essays, mentioned further on (see the catalogue).

***) Still we must mention that all the here indicated soils are united by a series of gradual transitions, often imperceptible, what is represented on the map and the specimens.

can be divided into three regions: south-eastern, central and the region on the other side of the Volga.

We present here the chiefest specimens of every indicated zone.

I.

NORTHERN RUSSIA

(Governments of Olonetz, St.-Petersburg, Novgorod, Smolensk, Vitebsk, Moguilev, part of the government of Vladimir, Moscow, the north-western and western governments of Russia etc.).

a) *Common northern turf soils* (see cut № 1); predominant colours—light-grey, brown, ash-coloured ect. *); humus, in the average, 1%, thickness of the soil (A+B) about 15—20 cm.; subsoil — different kinds of glacier formations,—argil, ground-sandy - argillous, argillous-sandy and sandy, very often full of, erratic blocks and silex. We give here some specimens of these soils.

№ 1. *Poustoi Brod*, district of Louga, government of St.-Petersburg. Slightly hilly locality. The specimen is taken at the half of a mild declivity; (thickness of the soil=14 cm.; vegetable mould (humus)—1%. The soil contains a lot of erratic silex and even blocks; subsoil — typical glacier block (see sketch № II).

№ 2. *Milukovo*, district of Sitchev, government of Smolensk. Tillage-land (thickness of the soil=16 cm.; vegetable mould (humus)—1.15%). Sub soil—sandy-argillous, argillous-sandy glacier block.

*) Such a variety of colours of the northern soils can be explained by the small quantity of humus contained in them, and that is why the influence of the various coloured primitive-rocks (sub soil) is here more evident than in any other region of soils.

№ 3. *Kreslovka*, district of Dunaburg, government of Vitebsk. Tillage-land; thickness—18 cm.; vegetable mould (humus)—0.56%.

№ 4. *Vladimir* on Kliasma, government of Vladimir. Tillage-land; thickness = 16 cm.; vegetable mould (humus)—1.04%.

№ 5. *Gorki*, government of Moguilev. Tillage-land; argillous-sandy soil has the type of podzol; thickness = 15 cm.; vegetable mould (humus)—1.09.

№ 6. *Schibanovo*, district of Kretezi; government of Novgorod. Field slightly hilly; damp locality. Typical podzol of forests. (Thickness = 9 cm.; vegetable mould (humus)—0.24).

№ 7. The same locality, only the specimen of the podzol is taken from a marsh, at a depth of about 70 cm., under a layer of turf; thickness of the podzol (marshy) = 30—35 cm.

To the same type of soil (I) belong the specimens №№ 57, 61 and 76, indicated further on.

b) *Northern* soils, sporadically met with—very rarely though, but very characteristic by their origin.

№ 8. *The isle of Lischni* on the sea Sandal, near Petrozavodsk, government of Olonetz. Tilled field—immediate produce of the efflorescence of the argillous schist (subsoil), contains a great deal of carbonic substances. Thickness of the soil of the tillage-land = 15—25 cm.; vegetable mould (humus)—7.02%. In the glass, the soil is put below, and beyond it—pieces of argillous schist.

№ 9. *Tivdia*, district of Petrozavodsk, government of Olonetz. Tillage-land immediate produce of the efflorescence quartz dolomite, lying beneath. The unaltered pieces of this lastone are contained in the glass. Thickness of the soil = 20—25 cm.

To the type of the soil of Tivdia belong also the soils of Staraya Ladoga (look further on, №№ 57, 58, 59 and 60).

II.

CENTRAL RUSSIA.

(Central part of the governments of Kazan, Nijny-Novgorod, Vladimir, Riazan and Toula, south-eastern part of the government of Kalouga, eastern part of the government of Orel, western region of the government of Koursk and central region of the government of Tschernigov, Kiev, Volhyn etc.).

Grey soils (different dark tints) forming transition from the typical northern soils to the typical tchernosem soils. Thickness (A+B) about 30—45 cm.; humus, in the average 2.5—3.5%. Subsoil—the same glacier formations, but less typical, having often the character of loess.

N^o 10. *Zaraïsk*, government of Riazan. Pasture; thickness=23 cm.; humus—2.50%.

N^o 11. *Riazan*. Tillage-land, slightly hilly; thickness=35 cm.; vegetable mould (humus)—2.66%.

N^o 12. *Steksovo*, district of Arzamas, government of Nijny-Novgorod. Tillage-land; thickness=50 cm.; vegetable mould (humus)—4.57%.

N^o 13. *Toula*. Pasture, slightly hilly; thickness=35 cm.; vegetable mould (humus)—2.54%.

N^o 14. *Berditchev*, government of Kiev. Tillage-land; thickness=68 cm.; vegetable mould—3.12%.

N^o 15. *Proscourov*, government of Volhynie. Locality slightly hilly; tillage-land; thickness=26 cm.; vegetable mould (humus)—3.37%.

III.

THE TSCHERNOSEM-ZONE OF RUSSIA *).

Principal types of the russian tschernosem.

A. South-western region of the tschernosem-zone of Russia (northern part of the government of Bessarabia, the western part of the governments of Ekaterinoslaw and Kherson, the southern region of the governments of Podolia, Volhyn and Kiev, all the government of Poltava and the nearest parts of the governments of Kharkov and Tschernigov etc). Dark-brown soils; humus, in the average, 4.5⁰/₀; thickness (A+B) about 80—85 cm.; maximum 1 metre 50 cm.; usual subsoil — sandy argillous loess.

N^o 16. *Népada*, district of. Soroka, Bessarabia. Steppe; thickness of the soil = 92 cm.; vegetable mould (humus) — 5.72⁰/₀.

N^o 17. *Iampol*, Podolia. Steppe; thickness = 75 cm.; vegetable mould (humus) — 3.73⁰/₀.

*) The tschernosem-zone of European Russia extends from south-west to north-east, on a surface of about 1800 — 2000 kilometres. Our collection shows, that the same tschernosem-zone passes the Oural, and in Siberia extends on a still larger surface. If we add, as belonging to the tschernosem-zone, the grey, transitory soils,—in general the soils containing humus more than 2⁰/₀, we find between the north-western and south-eastern frontiers of the tschernosem-zone in European Russia, approximately the following distances: Berditchev and Nikolaev—550 k., Taroussa and Konstantinovskaya on the Don — 700 k.,—Vassilsoursk and Alexandrov-Gay (district of Novouzensk)—600 k.; on the western side of the Oural — 700 k. Of course—here and there, especially in Siberia, the tschernosem-zone is interrupted by sands, different kinds of salt-rocks, marshes etc.

№ 18. *Bratechki*, district of Poltava. Steppe; thickness = 1 metre 22 cm.; vegetable mould (humus) — 7.73%.

№ 19. *Iékatérinoslav*. Steppe; thickness = 91 cm.; vegetable mould (humus) — 3.22%.

№ 20. *Krijopol*, district of Olgopol, Podolia. Pasture; thickness = 90 cm.; vegetable mould (humus) — 3.46%.

B. *Central region* of the tschernosem (black-earth) zone of Russia (governments of Kursk, Tambov, Saratov, Simbirsk, Penza etc.).

Black soils; humus, in the average, 8.9%; thickness 65 — 70 cm.; maximum 1 metre 12 cm.; usual subsoil — argillous-sandy loess, more rarely a production of the efflorescence chalk and cretaceous clay.

№ 21. *Losovaya*, district of Pavlograd, government of Iekaterinoslav. Tillage land; thickness = 92 cm. vegetable mould (humus) — 8.52%.

№ 22. *Mokhovoye*, district of Novossil, government of Toula. Pasture slightly hilly; thickness = 7.4 cm.; vegetable mould (humus) — 8.16%.

№ 23. *Gryasi*, district of Lipetsk, government of Tambov. Tillage land; thickness = 1 metre; vegetable mould (humus) — 9.6%.

№ 24. *Volkonskaya*, district of Borissoglebsk, government of Tambov. Tillage land; thickness = 7.3 cm.; vegetable mould (humus) — 9.15%.

№ 25. *Endovistche*, district of Zemliansk, government of Voronesch. Pasture; thickness = 95 cm.; vegetable mould (humus) — 11.42%.

№ 26. *Tagaë* (12 kilometres) district of Simbirsk. High, smooth table-land; thickness = 7.5 cm.; vegetable mould (humus) — 9.42%. (cut № III).

C. *Region on the other side of the Volga* of the tschernosem zone of Russia (governments of Samara, Oufa, the south-

eastern parts of the government of Kazan, the northern part of the government of Orenburg, etc).

Black soils; humus, in the average 9 — 10⁰/₀; thickness = 60 — 65 cm.; maximum 95 cm.; subsoil — eluvial productions of marly rocks (permian and triassic formations). — argil, argil-lous-sandy ground, etc.

№ 27. *Great Tolkich*, district of Tchistopol, government of Kazan. Steppe-field amidst a young forest of oaks. Thickness = 75 cm.; vegetable mould (humus) — 11.73⁰/₀.

№ 28. *Andréévka*, district of Bouzoulouk, government of Samara. Steppe covered with *Stipa pennata*. Thickness of the soil = 60 cm.;

№ 29. *Orlovka*, district of Menzélinsk, government of Oufa. Tillage-land; thickness = 70 cm.; vegetable mould (humus) — 11.31⁰/₀.

№ 30. *Bich-aoul*, district of Sterlitamak. Steppe; thickness of the soil = 65 cm.; vegetable mould (humus) — 9.42⁰/₀.

№ 31. *Karmaskaly* (on the river Bélaya), governm. of Oufa. Steppe; thickness = 65 cm.; vegetable mould (humus) — 11.55⁰/₀.

D. *Western Siberia*. Black soils; thickness about = 30 — 50 cm.; humus, in the best tschernosem-soils about 10⁰/₀.

№ 32. *Gidoussovo*, district of Ichim, government of Tobolsk. Tillage-land; vegetable mould (humus) — 13.54⁰/₀.

№ 33. *Steppe Barraba*, at ten kilometres on the west of Ichim, government of Tobolsk. Vegetable mould (humus) — 10.93⁰/₀.

№ 34. *Andruschi*, district of Tumen, governm. of Tobolsk. A smooth pasture; vegetable mould (humus) — 7.46⁰/₀.

№ 35. *Tolstoveretinskaya*, district of Kourgan, government of Tobolsk. Steppe covered with *Stipa pennata*.

E. *Eastern Siberia*. After what is known, there the tschernosem is the same as in western Siberia; only it is much lighter and is met with sporadically; as separate islots; thickness = 30 — 40 cm.

№ 36. *Startzevo*, at 22 kilom. from Krasnoyarsk; smooth locality; the soil artificially cut into small pieces; vegetable mould (humus) — 11.50‰.

№ 37. *Bobrovka*, between Ienisseisk and Krasnoyarsk. Tillage land amidst a small forest of birches; vegetable mould (humus) — 7.48‰.

IV.

NORTHERN SHORES OF THE BLACK AND AZOV SEAS.

Dark-brown soils; thickness, in the average, (A + B) = 60 cm.; humus, in the average, 4.5‰; as well as the grey soils, (II) these soils form a transition from the typical t s c h e r n o s e m to the brown or light-brown (often a kind of salt-rock) soils of the extreme south and south-east of Russia. Subsoils—tertiary argillous-sandy sediments, generally marly and argillous sediments, sometimes impregnated with gypsum, Na Cl, etc.

№ 38. *Kherson*. Steppe; thickness of the soil = 50 cm.; vegetable mould (humus) — 2.23‰.

№ 39. *Novoalexéevka* (4 kilom. from Sivach), district of Perekop, government of Tauria. Steppe covered with *Stipa pennata*; thickness = 7.0 cm.; vegetable mould (humus) — 6.02‰.

№ 40. *Taganrog*. Tillage-land; thickness = 70 cm.; vegetable mould (humus) — 4.44‰.

№ 41. *Novotcherkask* (at 5 kilom.). Pasture; thickness = 63 cm.; vegetable mould (humus) — 5.32‰.

V.

SOUTH-EASTERN RUSSIA.

Extreme south-eastern parts of the governments of Saratov and Samara, the southern part of the government of Orenburg, — all the government of Astrakhan, Tourkéstán etc.

The colour of the best soils light-brown, sometimes dark-brown or light-yellow; thickness (A + B) about 25 cm.; humus, in the average, 2.30⁰/₀; subsoil, usually caspic sediments, very often full of sea-salts.

№ 42. *Gorodistche*, district of Tsaritzin, government of Saratov. Pasture; thickness = 28 cm.; vegetable mould (humus) — 2.53⁰/₀.

№ 43. *Hofenthal*, district of Novooouzensk, governm. of Samara. Steppe; thickness = 30 cm.; vegetable mould (humus) — 3.37⁰/₀.

№ 44. *Novooouzensk*, governm. of Samara. Steppe; thickness = 15 cm.; vegetable mould (humus) — 3.03⁰/₀.

The two following soils must also be mentioned here.

№ 45. *Karataou*, on the peninsula of Manguischlak, near the spring Odnou, excavation in a rock.

№ 46. *Ousturt*, near the spring Koscha - Terekh. Pasture; vegetable mould (humus).

VI.

CRIMEA.

Dark-brown soils; thickness about 65 cm.; humus, in the average 3.5⁰/₀. Subsoil — mostly immediate productions of the efflorescence of tertiary clay and calcareous earth.

№ 47. *Simféropol*. Tillage land; neglected thickness 65 cm.; vegetable mould 4.24⁰/₀. Subsoil — pliocene clay.

№ 48. *Karamherkish* (table-land of Tarkhankout), district of Eupatoria, neglected field; subsoil, pontic clay; (thickness — 63 cm.; vegetable mould (humus) — 3.85⁰/₀.

№ 49. *Monaï*, district of Theodosia. Tillage land. Subsoil — sarmatic calcareous earth; thickness = 63 cm.; vegetable mould (humus) — 3.25⁰/₀.

№ 50. *Kaï-Assan* (near Sivach) district of Theodosia. Even locality. Subsoil — marly argil; thickness = 75 cm.; vegetable mould (humus) — 3.14%.

№ 51. *Wladislavovka*, district of Theodosia. Even locality. Subsoil — pliocene clay; thickness = 1 metre; vegetable mould (humus) — 3.11%.

VII.

NORTHERN SIDES (TABLE-LAND) OF THE CAUCASUS.

The typical tschernosem appears in separated islots, at the height of 2600 metres. Dark-brown soils; thickness about = 50 cm.

№ 52. *Krasny - Kamni*, near Kislovodsk, at a height of 945 metres. Virgin soil; vegetable mould (humus) — 5.50%.

№ 53. *Bermamout* (at 40 kilometres of Kislovodsk) at a height of 2065 metres. Virgin soil; vegetable mould (humus) — 16.03%.

The soil contains a lot of very small roots, which could not be removed before the analysis, which explains the excessive content of vegetable mould (humus) in the soil of Bermamut.

№ 54. *Oustar - Gordoï*, province of Tersk. Pasture; thickness of the soil = 63 cm.; vegetable mould — 7.06%.

№ 55. *Mineral waters*, province of Tersk. Pasture; thickness of the soil = 38 cm.; vegetable mould — 7.83%.

№ 56. *Iékatérinodar*, province of Kouban. Steppe; thickness = 81 cm.; vegetable mould (humus) — 5.94%.

VIII.

VERTICAL CUTS (SPECIMENS) OF THE PRINCIPAL TYPES OF SOILS IN EUROPEAN RUSSIA.

A. *Vegetable soil*, formed in historical times on the walls of the fortress of Staraya-Ladoga (see plate № IV); this fortress lies at the shore of the river Volkhov in the district of *Staraya-*

Ladoga, government of St.-Petersburg. During 770 years, on the walls of this fortress, partly still existing, formed itself, on silurian lime-stones, a soil (thickness (A+B) of 15—20 cm.) containing 3.53% of humus *). Here are exposed (4) samples of this soil and its subsoil, taken from different levels.

№ 57. Soil of *Staraya-Ladoga*; turf 5 cm. superior (A).

№ 58. Soil of *Staraya-Ladoga* (A) to a depth of 5 — 15 cm.

№ 59. Soil of *Staraya-Ladoga*; (B) to a depth of 15 — 20 cm.

№ 60. Silurian lime-stone (from the walls of the fortress) to a depth of 2—3 metres.

B. *Typical northern podzol (buck-ashes)* (see plate № V).

Lipnagorki, district of Tichvin, government of Novgorod. 4 samples

№ 61. *Lipnagorki*. Level of cultivated field-land; thickness 12 cm.

№ 62. *Lipnagorki*. Typical podzol (buck-ashes); thickness 17 cm., humus (black-earth) 0,5%.

№ 63. *Lipnagorki*, level of the Ortstein; thickness 22 cm.

№ 64. Primitive rock-diluvium argilo-sandy argil.

C. *Typical northern turf*, having been for a long time cultivated and strongly manured.

Village *Milukovo*, district of Sitchev, government of Smolensk.

№ 65. *Milukovo*, level of the soil (A); thickness 10—12 cm.

№ 66. *Milukovo*, transitory level (B); thickness 4—6 cm.

№ 67. *Milukovo*, under-soil (C) silicious argil; goes to a depth of 3—4 metres.

*) Such a large content of humus depends from the great quantity of herby roots, which could not be removed from the soil.

№ 68. *Milukovo*. Silicious sand, lies still deeper.

D. *Typical tschernoziem. Zubrilovka* (near to Kroutoï) in the district of Balashev, government of Saratov. Heath land; general thickness of the soil=1 metre, 12 (see plate № VII). In all 5 samples taken from the same cut.

№ 69. *Zubrilovka*. The upper 20 cm. of the soil (A) humus (black earth) 13,70%.

№ 70. *Zubrilovka*. The following 20 cm. of the soil (A).

№ 71. *Zubrilovka*. Sub-following 20 cm. of the soil (A).

№ 72. *Zubrilovka*. Transitory level (B) at a depth of 60—100 cm.

№ 73. *Zubrilovka*. Undersoil (C) conserving still traces of humus, deeper than 1 metr 12 cm.

E. *Typical wood-land* (argil) from the oakforests, growing amidst the tschernoziem (black-earth) zone in Russia (see plate № VI) *Shipoff-Forest*, in the district of Pavlovsk, government of Voronesh. All samples (12) taken from the same artificial cut at every 5 cm.

№ 74. *Shipoff-Forest* at a depth of 5 cm.

№ 75. " " " " " " 10 "

№ 76. " " " " " " 15 "

№ 77. " " " " " " 20 "

№ 78. " " " " " " 25 "

№ 79. " " " " " " 30 "

№ 80. " " " " " " 35 "

№ 81. " " " " " " 40 "

№ 82. " " " " " " 45 "

№ 83. " " " " " " 50 "

№ 84. " " " " " " 55 "

№ 85. " " " " " " 60 "

F. *Types of different under-soils in the tschernosem (black-earth) region.*

№ 86. Typical russian loess, at a depth of about 2—3 metres.

- № 87. Chalk.
 № 88. Bluish-grey caspian argil.
 № 89. Silicious marl.
 G. Ortstein (underneath the northern soils).
 № 90. Underneath turf-ground.
 № 91. Underneath oak-forests.
 № 92. Underneath asp-forests.

IX.

PRINCIPAL TYPES OF SOILS IN THE GOVERNMENT OF POLTAVA.

Group I. *Tschernosem (black-earth) highland.*

- № 93. Primitive heath of Boïarskoïe. Thickness (A + B) of the soil = 99 cm., humus (black-earth) 4.5%.
 № 94. *Bratechki*. Thickness of the soil (A + B) 1 metre 22 c.; humus (black-earth) 7.73%.

Group II. *Tschernosem (black-earth) in the valleys.*

- № 95. *Woronentzi*. Heath-acre. Thickness of the soil = 83 cm., humus 4.16%.
 № 96. Between *Kriukov* and *Olkhoviki*. Thickness of the soil = 86 cm., humus — 4.7%.

Group III. *Transitory (forming transion) woody-heath argils.*

- № 97. *Kolaydintzy*. Thickness of the soil = 81 cm.; humus — 3%.
 № 98. District of Polt. Thickness of the soil = 95 cm.; humus — 5%.

Group IV. *Woody argil.*

- № 99. *Clepatchi*. Thickness = 76 cm.; humus — 2.32%.
 № 100. *Dikanka*. Forest of Nicolaïew. Nut level.

Group V. *Tschernozem (black-earth) sands.*

Nº 101. *Brovarki*. Heath acres. Thickness of the soil to 1 metre 22 cm., humus — 1⁰/₀.

Nº 102. *Jassenovki*. Thickness to 1 metre 20 cm., humus 2.9⁰/₀.

Group VI. *Containing Salt.*

Nº 103. *Heath of Tamarov*. Level A.

Nº 104. The same. Level A'. White colour.

Nº 105. The same. Level B. Under-soil.

Group VII. *Quartzous sand.*

Nº 106. District of Polt. Humus less 0.5⁰/₀.

X.

PRINCIPAL TYPES OF SOILS IN THE GOVERNMENT OF
NISCHNI-NOVGOROD.

See the geological map of the said governm., the map of the district of Cniaginín and the cartogram of the district of Semenow.

Tschernozem (black-earth).

Nº 107. Tschernozem on the mountains *Salgan*, district of Sergatsch.

Nº 108. Tschernozem in the valleys, *Dubskoïe*, district of Cniaginín.

Nº 109. The same, *Steksovo*, district of Ardatov.

Argil-layers on loess-containing and silicious under-soil.

№ 110. Dark-brown argil, *Lukanovo*, district of Arzamas.

№ 111. Brown-grey argil on silicious under-soil, *Barischkino*, district of Nischni-Novgorod.

№ 112. Grey argil on silicious under-soil, *Wileyka*, district of Ardatov.

№ 113. Argil on loess under-soil (on the rising river-side of the Oka) *Tchmutovo*, district of Gorbatov.

№ 114. Containing buck-ashes (podzol) argil on silicious under-soil, *Purech*, district of Balatnine.

№ 115. Podzol (buck-ashes) lower level of the argil, containing buck-ashes. *Krassnaïa*, district of Gorbatov.

№ 116. Slimy argil, soil containing buck-ashes, *Telki*, district of Semenow.

Sandy layers.

№ 117. Sandy earth, *Tchudinovo*, district of Gorbatov.

Argillous sands.

№ 118. Argillous sand, *Kirilovka*, district of Arzamas.

Sands with a small supplement of argil.

№ 119. Sand mixed with argil, *Verijyanovo*, district of Ardatov.

Low ground on ancient alluvial soil.

№ 120. Low argil ground on a soil of ancient alluvial formation on the river Wolga, *Raznïejs*, district of Chakarov.

№ 121. Low sand on ancient alluvial soil at the river Wolga. *Bor*, district of Semenov.

Moist ground (contemporary alluvial formation).

№ 122. Argil ground of contemporary formation on the river Wolga. Poïma, Kapoustnik. *Koulaeva*, district of Balachnin.

№ 123. Sandy ground of contemporary alluvial formation on the river Oka. *Gnilitza*, district of Balachnine.

№ 124. Slimy tchernozem (black-earth) of alluvial formation on the river Alaty, *Itchalki*, district of Lukayanov.

XI.

PRINCIPAL TYPES OF POSTPLIOCEN-FORMATIONS IN RUSSIA.

A. Northern Russia.

№ 125. Common glacier rubble-stone. Environs of *St.-Petersburgh*

№ 126. Sandy layers with quartzous particles, *Frolistsche* govern. of Wladimir.

№ 127. Grey silicious argil, river *Kliasma*, government of Wladimir.

№ 128. Red silicious argil, *Kresti*, government of Kostroma.

№ 129. Sub-silicious sand, *Kresti* government of Kostroma.

№ 130. Silicious conglomeration a) red-town of *Wladimir* b) white rivulet *Serebrianka*, government of Wladimir.

B. Central Russia.

№ 130. Glacier rubble-stone, *Vershnitza*, district of Gorbatoff, government of Novgorod.

№ 132. Upper (underneath the soil) level of the loëss, *Bogoduhovo*, government of Orloff.

№ 133. Loèss of the mountains. *Nishni-Novgorod*.

№ 134. Loèss of the valleys, *Kamkino*, government of Nishni-Novgorod.

№ 135. Alluvial formation met at cavities. *Nishni-Novgorod*.

C. *Southern Russia.*

№ 136. Typical loess, *Novie Senjari*, government of Poltava.

№ 137. River - water marl, *Laistshinowka* government of Poltava.

№ 138. Silicious argil. *Padï*, government of Saratov.

№ 139. Alluvial formation met at cavities, *Ohonki*, government of Poltava.

The above mentioned specimens of soils (№ 1—56, 93—124), especially if examined together with the sub-indicated maps of soils (section C) give a sufficiently clear idea, not only of the geographical distribution of the principal soils on the surface of the russian ground,—they equally show the laws, to which is submitted the geography of the soils. Between the distribution of soils in Russia, the geology of the land, its relievo, character of the climate of the different zones, partly plants and animals,—exists (as is proved by a series of essays of different russian specialists), the most immediate and vivid connexion.

And in reality it must be like that. We are quite persuaded, that the same fact must be observed in America and on all the terrestrial globe.

We think, that this argument ought to be the uniting chain between the chiefest sections of natural history, and at the same time a guide for all naturalists.... Then only, we shall be able to conceive nature in its totality and in all its details and it will present itself to us as a completely achieved organism, really independent, harmonious and submitted to certain laws.

Still, examining the soils, as natural bodies, it is not sufficient to know only their horizontal distribution; in several cases it is more important to have a precise idea about their vertical extent, the thickness of the soil, their structure and their relation to the primitive-rocks.

For this purpose we have exposed the vertical cuts—(from nature) in specimens (№№ 57—92),—of the five most typical soils of Russia, and equally have added a series of drawings, representing the cuts of soils (B.).

B. Second section of the collection: vertical cuts of soils.

№ I. *Cut of the common virgin northern turfy soil, from nature.*

A. — level of the soil, thickness 18 cm.

B. — transitory level, very feebly limited; thickness about 5 cm.

C. — subsoil; common diluvial argillous-sandy earth, with rare blocks and erratic, silicious earth, often containing a lot of slightly decomposed grains of different local and northern primitive-rocks and minerals. This cut can equally be applied to all more or less good argillous-sandy and sandy-argillous soils of the southern part of Russia, where there is no tschernosem (region I).

№ II. *Cut of the northern uncultivated stony soil.*

A + B—soil containing a lot of blocks and silex; there are found whole parts exclusively composed of gravel of decomposed rappakivi (kind of finnish granit) thickness about 15 cm.

Typical glacier-rocks with small heaps (yellow-coloured) of sand and a lot of blocks and silex.

№ III. *Cut of typical virgin tschernosem, lying on the immediate productions of the decomposition of chalk.*

A. — immediately underneath the turf, formed by *Stipa pennata* and plants of steppes, lies the level of the soil—very dark tschernosem, composed of little grains with rare chalky silex, having the size of a nut. Thickness = 45 cm.

B. — Transitory level; much lighter colour; it contains a more considerable quantity of pieces of chalk; thickness = 30 cm.

C. Decomposed chalk or chalky clay; rarely lime-stone. The same tschernosem is often found in the governments of Simbirsk, Pensa, Saratoff, Charkoff, Kursk etc.

№ IV. Cut of vegetable soil, formed on the fortress of Staraya-Ladoga, built in the year 1116.

A. — level of the soil, grey-coloured with rare remains of lime-stone; dark-grey colour; thickness about 15 cm.

B. — transitory level; much lighter colour; considerably more remains of lime-stone; thickness about 5 cm.

C. — silurians lime-stone mixed with northern crystalline granite, diorite etc.

The given soil and cut clearly show the process of the formation of vegetable soils and give us the possibility of solving the most interesting process, concerning the age of soils.

№ V. *Cut of typical virgin podzol.*

A—level of the soil, grey coloured; thickness about 12 cm.

B—typical podzol; thickness about 15—20 cm. *

C—primitive rocks,—generally sandy-argillous glacier earth or argillous-sandy earth, containing sometimes erratic blocks.

Between the levels B and C sometimes are found narrow strips of the «Orthstein».

This soil occupies a considerable part of northern Russia; it is especially met with in forests and marshes.

№ VI. Cut of typical virgin forest soil, amidst the tschernozem region of Russia.

A'—superior level of the forest soil (felt) consisting of leaves and branches, tightly mixed with the mineral parts of the soil; dark-brown colour, thickness 4—5 cm.

A—level of the soil,—uniform mass, composed of grains, dark coloured in damp, and dark-grey in dry condition, with a scarcely perceivable blue tint; thickness 22 cm.

B—transitory nut-level, ashy colour, with a blue tint; it nearly all breaks into particles, resembling nuts—small pieces of irregular, angular shape with sharp edges; a grey floury substance covers these grains externally and even penetrates into the pieces themselves. In the level B there can be perceived until now two roots. Thickness=30 cm.

C—subsoil. dense, argillous mass, yellow-brown colour, with traces of nuts.

№ VII. *Cut of typical virgin tschernozem*, lying on loess.

A—level of soil. Immediately underneath turf (of *Stipa pennata* and other heath-plants) lies a uniform mass; in a moist condition, the humus gives it a black tint; on unploughed land it is nearly always mixed with roots of herbs, some of which are living, others destroyed.

The separate parts of the given level, have the shape of extremely small and irregular grains giving it the appearance of a granulated structure. Thickness of the level A—about 45 cm.

B—Transitory level, occupying according to its structure, colour and composition, a middle place between A and C. In fact, the dark tint gradually disappears; the granulated structure becomes less remarkable; the quantity of humus, argil and ceolits diminishes, whilst the carbonic salts, the sand etc. grow in %. The subterranean parts of the perennial plants exist here in a much smaller quantity than in the level of the soil (A) But perhaps the transitory level (B) is most characteristic by the usual presence of a lot of krotovines (issues, made by different

heath-rodents), which are here and there found as isolated spots. Thickness of the level. B—about 45 cm.

C—subsoil—common loess, though with a smaller content of carbonic salts in its superior levels; krotovines are found there to a depth of three metres and more. Thickness of the loess attains sometimes ten metres and more. This is the usual subsoil of russian tschernoziem.

C. Third section of the collection. Maps. tables etc.

№ VIII. Table, showing the relative quantities of the principal constituent parts of the soils a) of northern Russia (Viasma and Klin),—b) southwestern (Elisavetgrad and Vassilkoff) and central (Kroutoïe), tschernoziem part of Russia; the subsoil of the tschernoziem is also added, to serve as comparison. The weight of the constituent parts is given in poods (a pood=16.3799 kilograms) on a dessiatine (a dessiatine=1 hectare 224.997 square-metres) on a surface of 2.400 square «sagen» (miles); the depth of the soil—8 inches, is the same for all the types. The calculation is based on the specific weight of the soils. By sand we understand all the silicic acid, which is not soluble in 10% H Cl.

TABLE № VIII.

Principal constituent parts of the soils; in poods on one dessiatine.	Typical northern soils, Viasma and Klin.	Tschernoziem-soils of south-western Russia, Elisavetgrad and Vassilkoff	Tschernoziem of central Russia, Kroutoïe, governm. of Saratoff.	Subsoil of the tschernoziem (blackearth) Kroutoïe, to the depth of 1 metre 12 cm.
	poods	poods	poods	poods
Water H ₂ O	4.328	10.074	39.205	33.775
Humus	3.862	10.617	40.230	10.147
Azote N	421	417	1.528	218
Phosphorus acid P ₂ O ₅	128	285	517	432

Principal constituent parts of the soils; in poods on one dessiatine.	Typical northern soils Vlasia and Klin.	Tschernozem-soils of south-western Russia, Elisavetgrad and Vassilkoff	Tschernozem of central Russia, Kroutoie, governm. of Saratoff.	Subsoil of the tschernozem (blackearth) Kroutoie, to the depth of 1 metre 12 cm.
	poods	poods	poods	poods
Potash K_2O	293	5.841	5.773	5.825
Soda Na_2O	162	2.328	1.688	2.472
Lime Ca_2O	531	2.422	4.816	28.658
Magnesia MgO	897	2.005	3.964	4.212
Alum. Al_2O_2	14.900	23.816	42.966	42.246
Iron oxyde Fe_2O_3	4.74546	5.626	12.767	14.572
Silicic acid soluble in 10% HCl	162	26.594	54.157	26.984
Sand	303.766	240.262	101.302	118.824
Specific weight	2.52	2.45	2.30	2.36
Weight of the dessiatine . . .	342.000	332.000	312.000	318.000
(dessiatine — 1 hectare 224.997 square—metres).				

These facts, speaking clearly enough, do not want any further explication, and so we shall only mention, that the interest of these givens, their immense difference, would be a still greater one, if we had considered in our calculations not a uniform thickness ($= 8$ inches) of soils in different regions of Russia, but their real thickness, reaching on the north of Russia 15—20 cm., on the south-west 80—85 cm. and in the centre of the tschernozem 65—70 cm.

We shall add here, that if there exists between the separate regions of Russia such a difference, as well in the quantity of nutritive substances of soils, as in their colour and thickness, — (if we remember, that these regions present an essential difference in relation to the conditions of climate and the character of the wild vegetation), it will be quite clear, that the character of agricultural cultivation—the way of cultivating soils, the cultivated agricultural plants, manuring, and in general the whole system of agriculture—must be an essential

different one in the separate regions of Russia and strictly adapted to the natural conditions of her different physico-geographical regions.

Besides we must say, that if we use in Russia exclusively the superior 6—8 inches of soils, and if, notwithstanding in the region of the tschernosem is found a large quantity of grounds, where during a century have been got very good crops without any manuring (of course thanks to the favourable conditions of climate); if we remember, that the thickness of our tschernosem reaches a metre and more, and the subsoil (see table № VIII) of our tschernosem (black-earth) taken at a depth of a metre, exceeds, as to the content of humus, phosphorous acid, potash, lime (these principal elements of the fertility of soils), about three, five times and even more, our northern soils (they are very much like the west-european soils)—we get rather a clear idea about the marvellous, inexhaustible riches (unfortunately not yet sufficiently made use of,) contained in Russia.

№ IX. *Schematic map of soils of the tschernosem zone of Russia*, with the nearest neighbouring regions *), (scale 1 inch on 100 verst) the limits of the tschernosem are marked not only according to our facts, but according to the examinations of 1842, 1851 (Wesselovsky), 1866 (Rouprecht), 1869 (Wilson) and 1879 (Tschaslavsky).

On the map are indicated principally the izohumus-zones, into which is divided all our thschernosem region. As is seen on the map, in the centre of the eastern and central tschernosem regions, lies a zone with a content (in the average) **) of 13% — 16% of humus; in the western regions we

*) This map is added to the book «Russian tschernosem». Edition of the Imperial Economic Society.

**) Here, as well as in the other humus-zones are taken into consideration only the normal tschernosems, that is those lying in quite plain localities, whose subsoils are different kinds of sandy-argillous loess.

meet no such tschernosems. To the N., S. and W. of the given zone, extend the tschernosem-soils with a content of 10 to 13% of humus; they equally do not reach the western tschernosem part of Russia.

Still more to the north we find izohumus zones, first with 7—10% of humus, and then with 4—7%,—2—4% and so on, until we get to the regions of light-grey (on the north) red-brown and light-brown soils, often salt-rocks (on the south and south-west) where the content of humus descends to 2—1/2% and less.

It is very interesting to observe, if we move towards the south or from the Sivasch and Manitschi to the steps of the Crimean mountains and especially the Caucasus, that the soils again are more tschernosem ones—we meet there izohumus zones with 2—4% 4—7% (Crimea and Caucasus) and even 7—10% and more, of humus.

These are the principal laws of the geographical distribution of russian soils in general and especially tschernosem. They were fixed in the year 1882; but then the number of definition of humus in the russian soils was a comparatively small one, not exceeding 300; now (1889) this number is a three times, even five times larger one, but the results of course, are the same. It is true, (as could be expected), some of the izohumus zones have widened, their limits are now fixed more exactly (see governments of Nischni-Novgorod, Poltava and Kasan) amidst some or other zones were found islots of sand, salt-rocks, forest-ground etc. but the above mentioned character of the zones, the laws of its distribution in Russia, have acquired a greater steadiness and clearness.

Besides, the works of one of my pupils have proved, that our given scheme of the distribution of soils on the northern declivities of the Caucasus, can just as well be applied to those of the Tjanschan. Now it can be decidedly prophe-

sied, that around the whole ancient Arabo-Caspic basin (of course with more or less interruptions) extend the same izohumus zones, which we have represented on the Crimean peninsula and the Caucasus. And in this case, we shall find here strictly determined vegetative and animal zones, genetically united to the soil.

But this regularity and lawfulness in the distribution of soils in European Russia (and its neighbouring countries), is not only of a great scientific interest, it is not only important for the geologist, biologist and climatologist—this lawfulness, his regular dissection of eastern Russia into a series of zones of soils, has an immense practical importance,

The large empire of Russia exists by its soil, on its fertility is founded the wealth of the state, the commerce, in one word the whole life of millions of Russians, is inseparably united in Russia to the ground, to these or other natural powers of our soils.

№ X. *Map of the soils of Nischni-Novgorod* by W. Amalitzky, P. Barakoff, P. Zemiatschensky, F. Lewinson-Lessing, N. Sibirtzeff and A. Ferchmin, redacted by professor W. Dokoutschaïeff. Scale—10 kilometres on an inch. Edition of the zemstvo of Nischni-Novgorod.

This map shows clearly, that the whole government of Nischni-Novgorod is divided, in reference to its soils, into ten separate regions, or ten typical soils: A. *tschernosem* soils: 1) *tschernosem* of the table-land (weighty argillous-soils); 2) *tschernosem* of the valleys (argillous soils); B. *transitory* soils, 3) weighty argillous sandy ground; 4) middle argillous sandy-ground; C. *northern* soils; 5) light argillous sandy grounds; 6) sandy grounds; 7) argillous sands; 8) quartzzy sands of pine-forests; D. 9) marshy grounds; E. 10) dark soils. The first 8 types,—all belonging to the vegetative soils, are represented on the map, in their natural colour.

The map itself, as well as its supplements a) classification of soils of the government of Nischni-Novgorod (see the left superior corner of the map) and b) graphical description of the chemical, physical and geological character of soils (see the left inferior corner of the map) show clearly, that the colour, thickness, the relation to the subsoil, the capacity of absorption (concerning ammonia) the chemical and physical composition of the soils of Nischni-Novgorod, — essentially differ in all the single types. We know, that a lot of facts are in a continual genetic relation with one or the other character of local soils. These facts are: a) different species of cultivated and uncultivated plants, growing here and there; b) abundance of the crops according to the volume and weight; c) quality of the corn (rye, oats, wheats etc; d) value and duration of the action of the manure; f) density of the population (in the greatest part of Russia); in short, on the most important factors, tightly united to the soil, depends; g) the rent; h) the price of the lease; i) the income and k) the value of the grounds.—Thus there can be nothing more natural, lawful and positive, than to found all the economical and rural economical taxation of arable lands, on this natural-historical character of soils. This is what did the zemstvo of Nischni-Novgorod; and the zemstvo of Poltawa resolved to do the same.

№ XI. *Geological map of the government of Nischny-Novgorod* by M-r Amalitzky, Barakoff, Zemiatschensky, Lewinson-Lessing, Sibirtzeff and Ferchmin, redacted by professor W. W. Dokoutschaïeff. Edition of the zemstvo of Nischni-Novgorod 1886. Scale = 10 kilometres on an inch.

№ XII. *Map of soils of the district of Kniaginín*, government of Nischni-Novgorod 1892 (Scale = three kilometres on an inch) by N. Sibirtzeff.

In the year 1886, after the termination of the geological, geobotanical researches, by professor Dokoutschaïeff and

his collaborators, the zemstvo of Nischni-Novgorod, organized, another sequel of works for the taxation of grounds, statistical-economical researches, under the direction of N. Sibirtzeff.

They were charged to complete and develop the work of prof. Dokoutschaïeff, partly in the sense of more detailed characteristics of the different groups of soils, their species and varieties, but especially in referene to the topography of soils; in connection with the statistical facts of rural economy and grounds.

Principal results of the detailed investigation of the taxation of soils in the district:

There are accepted about eighteen species of soils, most of which belong to the light groups, fixed for the government of Nischni-Novgorod by prof. Dokoutschaïeff.

2) As to the character of the subsoil, that is, the geological type of the primitive rock, the clayey soils have formed paralel rows: dark clayey soils a) on the alluvial and dilluvial of southern argils; b) on the alluvial of streaked marls, c) on loess-rock; *grey and light clayey soils* a) on silicious and b) loess subsoil.

3) The character of the primitive rock traces a sharp limit between the soils, which contain the same quantity of humus and are nearly of the same colour; they differ from each other by their physical nature, mineral composition, and agricultural particularities.

4) Clayey soils on loess, subsoil, can be named light ones; they are very fertile and successfully produce spring wheat; clayey soils on silicious subsoil are of a more weighty composition, theyare especially fit for the sowing of oats and are on the whole less fertile; dark heavy clayey soils produce extremely well millet, wheat, barley.

5) The taxation of grounds, according to the character of soils corresponded with their fertility, alternation of sowing seed etc.

6) The territory of the district (4 thousand square kilometres) is divided into 105 regions, six taxational sections.

The natural qualities of the soils served in the given case as criterion for the taxation of soils and as basis for the distribution of the grounds into small territorial regions and taxational sections with a determined gradation of these lastones. The elaboration of the facts, concerning the fertility of the corn-land and fields, is made in application to the grouping of territorial districts after the soils, according to their natural classification *).

For every district is composed a detailed map of soils, scale—2 kilometres on an inch. As model of these maps we give that of the district of Kniaginín, the scale of which is diminished in printing to three kilometres on an inch. Besides the soils there are indicated: the relieve of the locality, rivers, lakes, forests, issues of the precipitating geological formations, limits of the extension of the silicious alluviums and the loess sub-soil, limits of the territorial regions and grounds, villages, schools, hospitals etc.

7) The topography of soils is represented on the map so distinctly, that every proprietor is able to distinguish on it the soils of his propriety.

8) The bad crop of 1891 was a differentone in the governments of Kniaginín (as every where) according to the types of soils: most of all have suffered by the pernicious influence of the frost and dryness, the sowings on compact, clayey soils in open forestless localities (mountain tschernosem, compact clayey soils on summits of mountains); sowings on light soils (loess clayey soils, sandy soils) have suffered comparatively less; the

*) The new taxation of lands after the soils and the new assessment of lands, are already put in force by the zemstvo of the districts of Makarievsk and Kniaginín.

abundance of nutritive elements in soils diminished the crop in those localities where the soil was not a too compact one and the corn-land lying near forests (tschernosem of the valley). See the table (Supplement I).

№ XIII *Cartogram of soils of the district of Semenoff*, government of Nischni-Novgorod. Scale 10 kilometres on an inch. Composed by N. Sibirtzeff, 1891.

Besides the above mentioned maps, there were composed abbreviated cartograms of soils, scale=10 kilometres, a sample of which is the cartogram of the district of Semenoff. On this map is especially to be remarked the distribution of arable soils into three large groups: a) soils proceeded of silicious formations; b) soils lying on sediments of glacier waters (blue strokes) and c) soils, proceeded of the alluvium of the river Wolga (green strokes).

To each of these three groups are belonging the clayey soils and sands,—all of which are grey or light coloured, but very different as to their agricultural importance. On the cartogram besides the arable soils, are shown marshes, woods, limits of silicious earth, some villages, territorial regions and their grouping after the taxational sections (table).

The example given by the zemstvo of Nischni-Novgorod was followed, as could be expected, by many others. In 1887—1888, the zemstvo of Poltava asked the author of this essay to compose a map of soils of that government. For this purpose during the summer of 1888 were undertaken preliminary works in the southern part of the government of Poltava, — Georgievsky explored the district of Poltava, Levinson—Lessing— that of Lubny, Polienoff — that of Chorol and Konstantinograd, Ferchmin— that of Kobeliaki Glinka— that of Romni, Zemiatschensky — that of Zenkov, Agafonoff — that of Pri-luki, Wassiljeff that of Lochwitzki, Bedisco— that of Mirgorod, Widrin — that of Piriatin, Bogoushevsky that of

Gadjatsch and Perejaslav and Pirozky — that of Zoloto-noscha.

The results of these investigations were the following maps of soils.

Nº XIV. *Map of soils of the government of Poltava*, by W. Agafonoff, N. Adamoff, S. Bogushevsky, A. Bodisko, M. Wasiljeff, W. Wernadzsky, I. Widrin, K. Glinka, P. Zemiatshensky, F. Levinson-Lessing, P. Otozky, F. Pirozky, B. Polienoff, A. Ferchmin, M. Scheschukoff, redacted by professor W. W. Dokoutschaïeff. Scale=10 kilometres on an inch. Edition of the Zemstvo of Poltava, 1893.

As the explorations of the government of Poltava were made after the same principles as those of the government of Nishni-Novgorod, the classification on the map of the government of Poltava also is the formerone: I tschernozem table—land; II tschernosem of the valley; III transitory forest heath argils; IV forest argils; V poïma; VI quartzous sand; VII salt containable.

The tschernosem table-land is divided into three sections, characteristic by a group of chemical and physico mechanical qualities. It is very interesting that such a division coincides with the orographical conditions of the government. On the whole, the investigation of the government of Poltava has given a great deal of highly interesting positive scientific as well as practical facts proving that the soil is a produce of the geology of the land, the relievo, climate, age etc. (see section D Nº 17). It equally helped us to demonstrate the following map of soils (XV).

Nº XV. *Map of the ancient ante-historical forest of the government of Poltava*, by professor W. W. Dokoutschaïeff and his pupils. Scale=10 kilometres on an inch. The surface of the forest, no more existing is painted yellow; still existing forests—green; these lastones, as very clearly is seen on the map, are poor remains of those rich forest regions, which of old sur-

rounded the heath table-land (see «Our steppes formerly and now»).

Nº XVI. The cards represent the same as the former one (XV) where by on the superior one are especially marked the present forests.

Nº XVII. The plans of the practical works on the experimental districts of the expedition of the administration of forests for the irrigation and cultivation of woods in Russia, under the direction of prof. W. W. Dokoutschaïeff (see «Preliminary account of the expedition»).

Nº XVIII. Map of soils of the estate of W. L. Narischkin, «Padi», district of Balaschov, government of Saratoff, Composed by P. A. Zemiatschensky, Scale = 2 kilometres on an inch.

The given map is a sample of those detailed maps of soils the composition of which is based on the explorations of professor Dokoutschaïeff in different places of Russia. In the space of time from 1888 to 1892, were examined, (0,2—1 kilometre on an inch) the following localities; Batischtscheff» government of Smolensk,—estate of A. N. Engelhardt; «Zapolje» government of St.-Petersburg, estate of Mr. Bilderling; «Woronzovka» estate of the prince Woronzoff count Schouvaloff etc. The signs, indicating the soils are the same ones as on the maps mentioned before.

Nº XIX. Map of soils of the «Kamennaja Step» district of Bobroff, government of Woronesch; composed by K. D. Glinka Scale = 0.5 kilometres on an inch.

This map was a result of the works, undertaken last year in one of the three districts chosen by the «Special Expedition of the administration of forests for the irrigation and cultivation of forests in the russian steppes» (See «Preliminary account of the Expedition»).

*D. Professor W. W. Dokoutschaïeff's and his
pupils essays.*

a) *Professor Dokoutschaïeff's essays specially treating the
russian soils.*

1) Results of the exploration concerning the russian tschernosem. 1877.

2) Preliminary account about the exploration of the south-western part of the tschernosem region of Russia. 1878.

3) Preliminary account about the exploration of the southeastern part of the tschernosem region of Russia. 1879.

4) Mappery of russian soils. 1879. Edition of the Department of Imperial Domains.

5) Tschernosem of European Russia. 1879.

6) About the general measures for improving the study of soils in Russia. 1880.

7) Answer to the remarks, made about the precedent report. 1881.

8) Course and principal results of the examination of russian tschernosem (black-soil), undertaken by the Imperial Economic Society. 1881.

9) Some facts concerning the Siberian tschernosem. 1882.

10) Schematical map of soils of the tschernosem-region of European Russia. 1882.

11) Russian tschernosem. Edition of the Imperial-Economic Society. This essay was rewarded by the Academy of Sciences of St. Petersburg and favoured by the prize of Makarieff.

12) About the origin of russian tschernosem. 1884.

13) About the so called tschernosem of Juriewsk; two articles. 1884—1885.

- 14) About the russian tschernosem. 1885.
- 15) About the institution of a comittée for soils in St. Petersburg. 1886.
- 16) About the usefulness of the study of local nomenclatur of russian soils. 1886.
- 17) Materials for the taxation of grounds of the government of Nischni-Novgorod. Natural historical part; volumes I—XIV; 1882—1886. Edition of the Zemstvo of Nischni-Novgorod. Volume I; many chapters of the XIII and XIV parts and all the other parts are edited by professor W. Dokoutschaïeff.
- 18) Explication of the map of soils of the government of Nischni-Novgorod. 1887.
- 19) About the normal taxation of soils in European Russia; two articles. 1887.
- 20) Methods which are to be followed for solving the question: have there been forests in the southern steppe-region of Russia?. 1888.
- 21) Program for the exploration of soils on fields. 1889.
- 22) About the connection existing between the age and height of the locality, and the character and distribution of tschernosems, forest grounds and salt—rocks 1891. Two articles.
- 23) About the origin of russian loëss. 1891.
- 24) Our steppes formerly and now. 1892.
- 25) *W. W. Dokoutschaïeff and N. M. Sibirtzeff*. Preliminary account of the expedition of the administration of forests for the irrigation and cultivation of forests in the steppes of Russia. 1892.

b) *Essays of W. Dokoutschaïeff's pupils, specially treating the soils of Russia.*

26) *F. Lewinson—Lessing.* About the tschernosem of Olo-netz. 1885.

27) *M. Danilovsky.* The salt—rocks of European Russia. 1885.

28) *W. Morosoff.* About the influence of the primitive rocks on the chemical composition of soils.

29) *P. Barakoff.* Experiments on the oozing of humus through artificial mixtures, of different mineral composition. 1886.

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